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Observations of the Leonids, 1898 November.

(*Communicated by Dr. G. Johnstone Stoney.*)

Extracts from letters written by Professor E. E. Barnard and Mr. J. W. Meares to Dr. Stoney.

Professor Barnard to Dr. Stoney.

"For some days preceding this date [November 14, astronomical time] the sky had been densely clouded all night (and day also). I began a watch on the night of the 11th, and continued this through without stopping until the 16th, and also in the latter hours of the 17th. These watches I kept up from 5 or 6 P.M. till 6 and 7 A.M. of each date, in hopes of getting even a moment's glimpse of the sky.

"The sky suddenly cleared shortly after midnight on the 14th. I soon saw there were a few meteors, but not noticeable, which could be traced back to the radiant, though they were mostly low in the N.W. near *α Cygni.* They became more frequent, and some large ones were seen. From this till daylight several hundreds were seen—many of the 1st magnitude, and a few brighter. Very few were seen near the radiant and none at it.

"They left bluish green streaks which persisted for a moment. There were no actual explosions; they simply increased rapidly in their light as if ploughing through a great resistance which rapidly consumed them. Their flight was very rapid, and their average position of appearance from the radiant would be 90° or much more. This would account for their great rapidity. Many appeared far west of *Orion* and quite a number in *Ursa Major.*

"As dawn began to show feebly they had markedly ceased, and before daylight had advanced enough to make much effect on the stars the meteors seemed to have ceased altogether. It seemed to me the maximum was reached between 3 and 4 A.M., perhaps nearer 4. It was the finest display of meteors I have yet seen.

"I had five cameras pointed to different parts of the sky, but from knowing their location no very bright meteors were seen to cross their fields. I have developed some of the plates, the least promising—those made at the tail-end of the display—but so far no trails.

"During frequent watches of the entire night of the 16th not a single *Leonid* was seen—the radiant seemed perfectly dead. The watch in the latter part of the night of the 17th gave the same result.

"I am inclined to think that the entire display was visible here on the morning of the 15th [civil time], and it had just begun when the sky cleared, and ceased before daylight. However, this point will be settled by observations elsewhere.

"We have a few counts here that may settle the maximum."

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In a subsequent letter dated 1898 November 26 Professor Barnard refers to a telegram he had received from Dr. Stoney, calling his attention to November 15^{d} 17^{h} G.M.T., as being the time when the earth would reach the node of the instantaneous ellipse which on that date osculates the orbit of the part of the stream through which the earth passed in 1866, if we assume the correctness of Adams's elements, and take account of the perturbations which have affected the orbit since 1866. Referring to this, Professor Barnard writes :—

"This would place the event November 15^{d} 17^{h} G.M.T. On that night the radiant was dead ; no meteors were seen that could in any way be assigned to it. The maximum as observed here would appear to have been not far from November 14^{d} 21^{h}–22^{h} G.M.T."

Yerkes Observatory, Williams' Bay, Wisconsin :
1898 *November* 20.

Mr. J. W. Meares to Dr. Stoney.

"I kept a watch for the *Leonid* meteors here on the 13th and 14th instant.

"On the 13th I only watched from 12^{h}–13^{h}. There was a heavy mist low down, and no stars could be seen lower than 15° from the horizon. No meteors at all were seen. On the 14th it was quite clear, and I watched from 12^{h}–14^{h}. There were exceptionally few meteors seen, and of these only 4 appeared to have been *Leonids*. I have made no attempt at determining the radiants, as I am inexperienced in this work. A list of the meteors is given below.

" *Writers' Buildings, Public Works Department, Calcutta :*
1898 *November* 16.

"Calcutta Local Time. 1898 Nov. 14.		Mag.	
h	m		
12	5	−1	White, lasting trail, quick, from Taurus eastward.
12	30	−1	Yellow, trail momentary, quick, *Leonid* (1).
12	33	4	Yellowish, no trail, very quick.
12	53	4	„ „ „
12	56	faint	„ „ „
13	0	1	Yellow, bright trail, quick, *Leonid* (2).
13	6	faint	Yellowish, no trail, very quick.
13	15	„	„ „ quick.
13	15½	1	Yellow, bright trail, quick, *Leonid* (3).
13	23	1	„ „ „ *Leonid* (4).
13	28	faint	Yellowish, no trail, very quick.
13	35	−1	Orange, short trail, very quick.
13	43	faint	Yellowish, no train.

"Up to 14^{h} no more meteors.

"Calcutta local time, 5^{h} 53^{m} east of Greenwich."

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It appears from these letters that the observations in India were made from twelve to ten hours before the beginning of the shower which visited America; and accordingly that the *Leonids* observed in India were a few *clino-Leonids*, the sparse shower of which lasts several days. On the other hand, the much denser display which was seen in America was fortunately observed from its commencement till its close. It was thus ascertained that it lasted only a moderate number of hours; from which we may infer that the Earth has this year passed through the extreme front of the main stream, which consists of *ortho-Leonids*, and the denser parts of which produce the imposing spectacle in the Earth's atmosphere of Great November Showers.

Observations of Meteors made at the Royal Observatory, Cape of Good Hope, on 1898 *November* 13 *and* 14. By David Gill, C.B., F.R.S., &c., Her Majesty's Astronomer.

Besides provision for eye observations, five cameras were exposed from midnight till daylight on November 13 and 14. These were arranged so as to cover an area of the sky limited by two circles of about 20° and 50° in radius, having their common centre in the radiant (R.A. 10^h, Decl. $+22^\circ$). A Cooke doublet of 5 inches aperture and 19 inches focus was directed to the radiant as soon as it had risen sufficiently above the horizon. All these cameras were attached to equatorials driven by clockwork and carefully guided throughout the exposure. The plates were exchanged every hour.

Besides an observer, whose duty it was to attend to the guiding of each telescope, another observer was on the watch with each telescope to record the time and position of every meteor that crossed the field covered by each particular camera. The sky was perfectly clear, but no meteors of remarkable brilliancy crossed the fields of the cameras, and those approaching the brightness of 1st magnitude stars moved so swiftly as not to impress any visible record on the plate.

The meteors in the area of Pickering's charts of the radiant were specially observed by Mr. J. Power. Mr. Innes observed the sky towards the south-east, and Mr. W. de Sitter more particularly to the north-east.

Messrs. Power and de Sitter were chiefly on the outlook for meteors radiating from *Leo*, but they also noted a good many radiating from *Orion*. Mr. Innes endeavoured to note all the meteors visible in the area watched by him.